

U.S. ANTARTIC PROGRAM, 2002-2003



The U.S. flag flies at the American research station Palmer in the Antarctic Peninsula. (NSF/USAP photo by David Bresnahan)

As part of the U.S. Antarctic Program, nearly 700 researchers and special participants will conduct 141 projects during the 2002–2003 austral summer, with some projects continuing through the austral winter. Supported by over 2,000 civilian contract employees and U.S. military personnel, these researchers and such special participants as writers, artists, and teachers will work at the three U.S. year-round stations (McMurdo, Amundsen–Scott South Pole, and Palmer), at remote field camps, with other national antarctic programs at locations around Antarctica, and in the waters of the Southern Ocean aboard the U.S. Antarctic Program’s two research ships—the icebreaking research ship *Nathaniel B. Palmer* and the ice-strengthened ship *Laurence M. Gould*.

These projects, funded and managed by the National Science Foundation (NSF), are part of the international effort to understand the Antarctic and its role in global processes. NSF also supports research that can best be performed or can only be performed in Antarctica. Besides research projects, NSF’s Office of Polar Programs (OPP), which manages the antarctic program, supports Teachers Experiencing Antarctica (TEA), which strives to create a polar learning community of teachers, students, school districts, and researchers. As part of their professional development, six teachers, which NSF selects competitively, will work with six research teams this austral summer. U.S. Antarctic Program investigators volunteer to include TEA participants in their field parties. Another OPP program—the Antarctic Artists and Writers Program—provides opportunities for painters, photographers, writers, and others to use serious writing and the arts to increase people’s understanding of the Antarctic and America’s heritage there.

The scientists conducting the projects come primarily from U.S. universities and have won NSF support by responding to the Antarctic Research Program Announcement and Proposal Guide (NSF 01–81; <http://www.nsf.gov/pubsys/ods/getpub.cfm?nsf02086/>). Operational resources in Antarctica are also used to support scientists from other Federal agencies.

Science highlights

The following projects are among those supported in Antarctica this austral summer and winter. Where

applicable, links for additional information have been added. Information on NSF-funded science awards can also be found in the online NSF awards database. To access this information, search the awards database at <http://www.fastlane.nsf.gov/a6/A6AwardSearch.htm>. Each NSF award listed there includes the award number, which can be used to do a keyword search.

- **Long-term ecological research (LTER).** Two sites in Antarctica—one in the McMurdo Dry Valleys and the other along the west coast of the Antarctic Peninsula centered on Palmer Station—are among the world's 25 NSF-sponsored LTER sites, which are being investigated to increase our understanding of ecological phenomena over long temporal and large spatial scales (all but one of the other sites are in the United States) (<http://lternet.edu/>).
- **West Antarctica GPS Network (WAGN):** Researchers this season will begin to deploy a series of Global Positioning System transceivers across the interior of the West Antarctic Ice Sheet — an area approximately the size of the contiguous United States from the Rocky Mountains to the Pacific coast. The ability to measure the motions of the Earth's crust in the bedrock surrounding and underlying the West Antarctic Ice Sheet is critical to understanding the past, present, and future dynamics of the ice sheet and its potential role in future global change scenarios, as well as improving the understanding of Antarctica's role in global plate motions. WAGN will complement existing GPS projects by filling a major gap in coverage among several discrete crustal blocks that make up West Antarctica — a critical area of potential bedrock movements.
- **West Antarctica GPS Network.** Researchers are deploying global positioning system (GPS) transceivers across the West Antarctic Ice Sheet—an area the size of the United States from the Rockies to the Pacific. Measurements of motions of the Earth's crust in the bedrock around and under the West Antarctic Ice Sheet are critical to understanding its dynamics and its potential role in global change, and they improve our understanding of Antarctica's role in global plate motions. This network complements existing GPS projects by filling a gap in coverage among the crustal blocks that make up West Antarctica (http://www.ig.utexas.edu/research/projects/gps/wais_bedrock/wais_bedrock.htm/).
- **International Transantarctic Scientific Expedition.** The U.S. component of the multiyear International Transantarctic Scientific Expedition (U.S. ITASE) is making the fourth of four traverses over the West Antarctic Ice Sheet this season. The aim is to understand the past 200 years of west antarctic climate and environmental change. Researchers are collecting shallow ice core and snow pit samples for ice chemical analyses, shallow and deep radar data to look at internal layer reflections and bedrock topography, atmospheric samples, and meteorological readings to understand the current climate of the ice sheet. The data contribute to our understanding the West Antarctic Ice Sheets of both today and the recent past (<http://www.ume.maine.edu/USITASE/>).
- **Historic huts.** Researchers are finding the biotic and nonbiotic agents that cause deterioration in historically significant huts built by antarctic explorers in the early 20th century. While the polar environment has protected some artifacts from rapid decay, degradation is still a concern. Conservators from the United States and New Zealand are studying mechanisms of decay, testing methods to control future deterioration, determining the extent of pollutants in soils at the sites, and evaluating chemical spills in the huts (<https://www.fastlane.nsf.gov/servlet/showaward?award=9909271> [U.S. research grant from NSF]; <http://www.antarcticanz.govt.nz/Pages/Logistics/ScienceEvent.msa/> [New Zealand project K-021]; <http://www.newscientist.com/news/news.jsp?id=ns99993018> [*New Scientist* article, November 2002]).
- **Combustion effluent in the McMurdo Dry Valleys.** Antarctica is comparatively pristine, but the human presence there could possibly affect some science, so researchers are measuring carbonaceous aerosols ("black carbon") in the McMurdo Dry Valleys. The aerosols could come from diesel generators, from helicopters, or even from McMurdo Station itself (100 kilometers away). The data will help assess the impact of human activities and the benefit of converting to solar power at research camps. The units will transmit to the Internet until the end of the 2002-2003 season (Measurement of Combustion Effluent Carbonaceous Aerosols in the McMurdo Dry Valleys, Antarctica, Anthony D. Hansen, Magee Scientific

Company, NSF award OPP 98-15140).

- **South Pole Astrophysics:** Telescopes at the South Pole are continuing investigations into the origins of the universe (<http://astro.uchicago.edu/cara/>). For example, the degree angular scale interferometer (DASI), which has been measuring the cosmic microwave background (CMB) at the South Pole since the 1999-2000 season, has precisely measured minuscule variations in the afterglow of the Big Bang, verifying the theoretical framework that underlies the modern scientific concept of how the universe came into being. The discovery is so fundamental that it may also provide a key to an even keener understanding of the origins of the universe. In 2003, DASI will measure the currently undetected polarization of CMB anisotropy to test the standard theory of the early universe. Team members are reconfiguring DASI from 30 gigahertz (GHz) to 100 GHz for intensity and polarization measurements of the fine-scale CMB anisotropy power spectrum. (<http://astro.uchicago.edu/dasi/>).
- **Arcminute Cosmology Bolometer Array Receiver.** Advances that are revolutionizing cosmology include the Arcminute Cosmology Bolometer Array Receiver, which measures slight temperature differences in the CMB. Images to date in four frequency bands exploit the excellent millimeter and submillimeter atmospheric "windows" at the South Pole, providing a snapshot of the universe in its infancy and strongly constraining its possible constituents and structure. These detailed images, along with existing observations made by others, comprise a continuous and consistent description of primary CMB anisotropy. In this second season of observation, team members are operating and upgrading the instrument, preparing it for winter, and calibrating the previous winter's observations (<http://cosmology.berkeley.edu/group/swlh/acbar/>).
- **Snow megadunes.** Megadunes of the East Antarctic Ice Sheet are subtle features, which are 2 to 4 meters in amplitude over a 2- to 4-kilometer wavelength and have just recently begun receiving significant research attention. These megadunes may affect the interpretation of climate in deep ice cores. Investigators are conducting ground-penetrating radar surveys, global positioning surveys, firn cores, pit sampling, automatic weather station installation, and snow permeability experiments to determine the physical and chemical characteristics of the dunes to help us understand their significance, including their effect on ice cores (<http://nsidc.org/antarctica/megadunes/>).

Construction highlights

- **Science support center.** Phase 1 of a new science support center began operating at the beginning of the season. When completed, phase 2 will increase the effectiveness and efficiency of science support and will enable demolition of the existing science support facility (Building 58), one of McMurdo's oldest and least efficient structures.
- **Waste-heat recapture.** A multiyear project is under way to capture McMurdo power plant waste heat for
 - heating feedwater to the reverse-osmosis water plant, and
 - space-heating the science laboratory, dormitories, and other buildings.
- **Joint Space Operations Center.** This multistory building near the center of McMurdo Station, funded by the National Aeronautics and Space Administration and NSF, has been erected and when complete will enable consolidation of much of McMurdo's satellite ground station activities.
- **South Pole Modernization Project.** Major renovation is under way to replace most of the 26-year-old South Pole Station's central facilities, which have exceeded their design life and cannot meet projected science demands. To date, a new fuel storage facility, a new garage and shop, and a new electric power plant have become operational. Living facilities are being modernized, with construction of housing and food service wings of the new elevated station. Exteriors of wings that will house station services, medical facilities, and science labs were completed last season, with the interiors being completed during the winter. Additional wings are being erected this season. The station is scheduled for completion in 2007.

- **Palmer Station improvements.** An upgrade of the two major buildings at Palmer Station, lasting several years, has essentially been completed, increasing the effectiveness of science support and living facilities. A ground station installed in 2002 has extended the station's Internet communications to 24 hours a day.

U.S. Antarctic Program, 2002-2003

Sites of major activities

